PERMEABLE REACTIVE BARRIER WALL WORK PLAN
DUPONT EAST CHICAGO SITE
EAST CHICAGO, INDIANA

July 2001 **Project No. D4EC7356**

Prepared by

CORPORATE REMEDIATION GROUP
An Alliance between
DuPont and URS Diamond

Barley Mill Plaza, Building 27
Wilmington, Delaware 19805

PERMEABLE REACTIVE BARRIER WALL WORK PLAN
DUPONT EAST CHICAGO SITE
EAST CHICAGO, INDIANA
IND 005 174 254

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Barley Mill Plaza, Building 27
Wilmington, Delaware 19805

DuPont Engineering
Barley Mill Plaza - Bldg. 27
Lancaster Pike & Rte. 141
Wilmington, DE 19805

DuPont Engineering

July 2, 2001

Mr. Allen T. Wojtas
Environmental Engineer
U.S. Environmental Protection Agency
77 W. Jackson Blvd., DE-9J
Chicago, IL 60604-3590

Permeable Reactive Barrier Wall Work Plan
DuPont East Chicago Site
East Chicago, Indiana
IND 005 174 254

Dear Mr. Wojtas:

This letter serves as the Interim Remedial Measure (IRM) Work Plan to address migration of arsenic-contaminated groundwater towards Riley Park, located north of DuPont property. During our March 8, 2001 meeting, we described the concept and basis of Permeable Reactive Barrier (PRB) technology and its applicability to the East Chicago site. Since then, we have completed the necessary pre-design work including surveying activities, characterizing surficial and subsurficial soils, and preparing the conceptual PRB wall engineering design. Additionally, we researched potential permitting requirements with the Indiana Department of Environmental Management (IDEM) and the City of East Chicago.

BACKGROUND

The U.S. Environmental Protection Agency (EPA) issued an Administrative Order on Consent for the site, which was signed by DuPont on June 26, 1997. The order specified that DuPont perform work consisting of interim measures (specified to be the implementation of the Sediment and Wetlands Investigation Plan for the East Branch of the Grand Calumet River, adjacent to the DuPont site), a RCRA facility investigation, and a corrective measures study. DuPont submitted a draft report titled, *Sediment Characterization Study for the DuPont East Chicago Facility,* in September 1999. DuPont submitted a *Draft Phase I RFI Report* on September 27, 2000.

In the *Draft Phase I RFI Report*, DuPont found that groundwater containing levels of dissolved arsenic exceeding the screening criteria was migrating to the north towards Riley Park. Although DuPont found no unacceptable risk to Riley Park residents from potential exposure to contaminated groundwater, DuPont recommended that field testing of PRB test wells be continued to support the design and construction of a PRB in 2001. DuPont reviewed the PRB concept with EPA on March 8, 2001 and indicated that a work plan would be submitted to EPA by mid-summer.

OBJECTIVES

DuPont plans to construct a PRB to reduce arsenic concentrations in groundwater. The PRB will parallel the northern property line (200-ft. setback from property fence line) and laterally overlap the Riley Park residential area. Basic Oxygen Furnace (BOF) slag will be used as the PRB reactant to remove dissolved arsenic from the groundwater. Field tests indicate that a PRB constructed with BOF slag will reduce arsenic concentrations (maximum concentration of about 1,500 ug/l) to non-detectable levels (with method detection level of 5 ug/l).

PRB WALL INSTALLATION DETAILS

- Dimensions: The PRB will be constructed to the length of approximately 2000 linear ft. and depth of approximately 35 ft. (varies). The width of the PRB will be 2.75 ft. with an allowable tolerance of ± 0.25 ft. The PRB will consist of 100% BOF slag for the vertical depth specified. The location of the PRB is depicted on the attached drawings.

- Geotechnical Information in the Work Area: Subsurface exploratory borings have been drilled to evaluate the soil stratigraphy in the work area. Boring locations (designated as WB-1 through WB-23) are shown on the attached drawings. Soil classifications are the result of field visual classifications in accordance with the Unified Soil Classification System (USCS) and appear on boring logs contained in the *Geotechnical Investigation Report* (a copy can be provided if requested). The logs indicate that the soil profile consists of approximately 5 ft. of waste ash underlain by 30 ft. of natural sand with a continuous silty clay unit at the sand base.

- PRB Trench Depth and BOF Slag Placement: The top elevation of the BOF slag placement will vary. It will be field verified to be a vertical distance of 1 ft. below the waste ash—natural sand interface at all locations along the PRB alignment. The bottom elevation of the PRB trench will be field verified to be a vertical distance of a minimum of 2 ft. into the confining silty clay unit as shown on the attached drawings. The PRB trench atop the BOF slag will be backfilled and compacted with natural sand (no waste ash) recovered from the PRB trench.

- PRB Trenching: Trench excavation for the PRB will be performed either by slurry or non-slurry trenching methods. Potential slurries, which may be utilized, include Guar Gum, Xantham Gum, or a mix of Guar/Xantham Gum. The slurry mix will be tested in the laboratory with actual site groundwater and soils prior to its use in the field.

- BOF Slag: The grain size and chemical composition of BOF slag to be used in the construction of the PRB is as shown below:

SIEVE SIZE	PERCENT RETAINED
3/8"	100%
#4	75-100%
#8	40-90%
#16	20-50%
#30	10-30%
#50	8-24%
#100	0-20%
#200	0-12%

COMPONENT	WEIGHT PERCENT
Fe metal	3%
FeO	24%
Fe2O3	3%
CaO	30%
MgO	12%
SiO2	10%
Al2O3	2%
MnO	2%
P2O5	0.2%

- Soil Erosion and Sediment Control: Temporary soil erosion and sediment control measures will be installed prior to the start of the PRB construction activities.
- Underground Utilities: The identified utilities that will be impacted during the construction of the PRB include an active sanitary force main and a high-pressure nitrogen line. Both cross the proposed alignment of the PRB and are depicted on the attached drawings. Temporary measures will be installed to protect the nitrogen gas line and the sanitary line during the installation of the PRB. As an additional precaution, the nitrogen line will be deactivated prior to the start of work.

HEALTH AND SAFETY PLAN

A site-specific Health and Safety Plan (HASP) for the project is currently being prepared by DuPont and will be completed before the start of PRB construction activities.

WASTE MANAGEMENT PLAN

The PRB will be constructed in an area identified as Solid Waste Management Unit-1A (SWMU-1A) that is currently subject to a RCRA Facility Investigation (RFI). The limits of SWMU-1A are depicted on attached drawings. The contractor will manage the wastes generated as a result of PRB construction in accordance with EPA's "Area of Contamination" (AOC) policy[1]. The AOC policy applies to any hazardous remediation waste. Waste characterization borings along the PRB footprint (designated as WC-1 through WC-21) indicate much of the SWMU-1A surficial material (to an average depth of 5 ft. from grade) possess the hazardous characteristic of EP-toxicity (D006 and/or D008). This material has been classified as waste ash and is depicted on the PRB profile provided as part of the attached drawings. All soil excavation, reuse, consolidation and

[1] *Management of Remediation Waste Under RCRA*, Memo from Timothy Fields, Jr., Acting Assistant Administrator for Solid Waste and Emergency Response and Steven A. Herman, Assistant Administrator for Enforcement and Compliance Assurance, October 14, 1998.

grading will be conducted within the boundaries of the AOC in accordance with the waste management plan.

Monitoring well data indicate that groundwater would not have a hazardous characteristic for the metals contained in the waste ash. Therefore, a groundwater recharge basin upgradient of the proposed PRB will be utilized for groundwater management during the construction activities. The following paragraphs summarize the anticipated quantities and disposition of residuals:

- Waste Ash (Fill): An estimated 1,000 cubic yards of fill material will be excavated from the PRB trench. The excavated fill material will be placed in a location south of the proposed PRB location and spread in a rectangular area having approximate dimensions of 65 ft. x 65 ft. and graded between Elev. 590 and 592. The proposed placement area of the fill material is depicted in Drawing 5.

- Natural Sand: An estimated 6,000 cubic yards of natural sands will be excavated from the PRB trench. Approximately 1,225 cubic yards of the excavated material will be placed and compacted within the PRB trench between the top of slag and original grade. The remaining 4,775 cubic yards of material will be used as a cover over the fill material recovered from the PRB trench as discussed above. The proposed placement area of the natural sands is depicted in Drawing 5.

- Groundwater: Groundwater, if recovered during the construction activities, will be reinjected via recharge pits at locations upgradient to the established groundwater flow gradient beneath the site.

- Decontamination Water: Decontamination procedures will be implemented using "clean water." All residuals generated in the process of implementing the decontamination procedures will be handled in accordance with the site-specific Waste Management Plan currently being developed by DuPont.

- Personal Protective Equipment (PPE): All PPE generated during the construction activities will be drummed and disposed at an off-site location in accordance with the applicable federal, state and local rules and regulations.

PERMITTING REQUIREMENTS

The PRB Wall will be installed subject to approval of this IRM Work Plan by the EPA. Representatives of EPA and IDEM have informed DuPont that there are no specific permit approvals required before proceeding with the installation of the PRB. DuPont has contacted the City of East Chicago and determined that a local construction permit is required. As a prerequisite to permit consideration by the City Planning Commission, DuPont presented the PRB project plan to the City Technical Review Committee on June 19, 2001. DuPont anticipates permit approval on or about July 16, 2001.

DuPont will prepare a fact sheet that will be used as a basis for public information and communication. The fact sheet will be made available to EPA, IDEM, and the City of East Chicago prior to the start of PRB construction.

POST-IRM MONITORING

Subsequent to PRB installation, a monitoring plan will be implemented to evaluate IRM success. The monitoring plan will include installation of additional monitoring wells and piezometers and collection of water quality and water-level data to confirm predicted results. The monitoring plan will be submitted to the EPA for review prior to completion of the PRB installation.

SCHEDULE

The table below lists the primary milestones and anticipated completion dates for the IRM. Please note that mobilization is scheduled for August 2001. However, weather conditions may necessitate schedule changes. EPA and IDEM will be informed of any schedule changes that significantly alter the planned completion date.

Task	Completion Date
Review Concept with U.S. EPA	March 8, 2001
Transmit Bid Package to Prospective Bidder	June 13, 2001
Submit Work Plan to U.S. EPA and IDEM	July 2, 2001
Review and Award PRB Construction to Successful Bidder	July 12 – August 24, 2001
Receive City Construction Permit	July 16 – 30, 2001
Contractor Mobilization	August 27, 2001
Submit IRM Monitoring Plan	Before October 9, 2001
Demobilization and Site Restoration	October 9, 2001
Implement Post-IRM Monitoring Plan	After October 9, 2001

Based on the laboratory and field test results, DuPont is confident the PRB Wall will meet the IRM objectives. Post-IRM monitoring will confirm the effectiveness of the IRM.

DuPont plans to implement the above outlined IRM as described in this work plan unless objections are raised by the U.S. EPA prior to mobilization. If you have any questions or require additional information, please do not hesitate to contact me at 704-362-6628 or Alan Egler at 302-892-1296.

Sincerely,

Hilton Frey (APE)

J. Hilton Frey
Project Director

Attachments

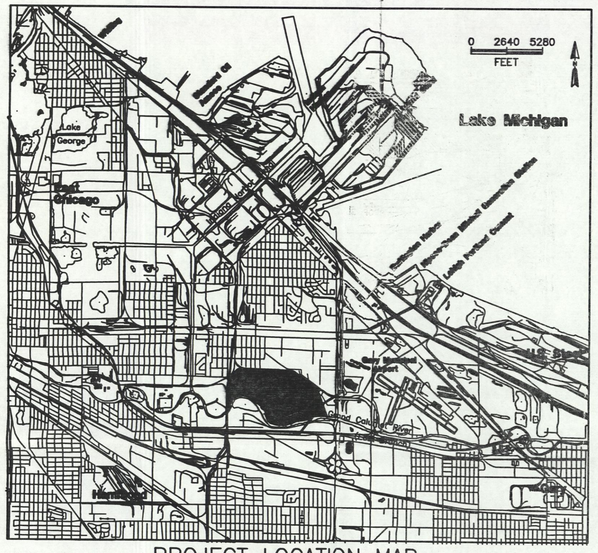
cc: Alan Egler, URSD
Rajiv Sinha, URSD

Attachment 1

Construction Drawings

DUPONT EAST CHICAGO SITE

PERMEABLE REACTIVE BARRIER



PROJECT LOCATION MAP

PREPARED FOR:

DUPONT

Corporate Remediation Group

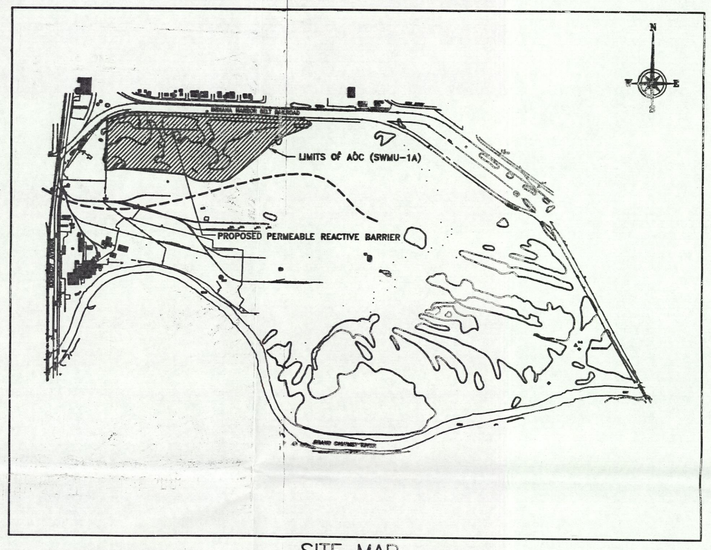
An Alliance between
DuPont and The URS Diamond Group

BARLEY MILL PLAZA, BUILDING 27
WILMINGTON, DELAWARE 19880-0027

PREPARED BY:

URS Corporation

JUNE 2001



SITE MAP

FOR BIDDING PURPOSES ONLY
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LEGEND

EXISTING FEATURES

- ACCESS / HAUL ROAD
- 10 — CONTOUR AND ELEVATION (FT.)
- FENCE
- MH — MANHOLE
- WB-8 — GEOTECHNICAL BORING LOCATION
- WC-21 — WASTE CHARACTERIZATION BORING LOCATION
- 9.5 — SPOT ELEVATION
- UTILITY POLE
- DENSE WOODS/BRUSH
- TREELINE
- CENTERLINE OF PIPE
- PROPERTY LINE
- RAILROAD TRACK
- EDGE OF WATER
- SIGN
- CONTROL POINTS
- BUILDING

PROPOSED FEATURES

- 2+00 — ℄ STATIONING
- PERMEABLE REACTIVE BARRIER
- 15.6 X — SPOT ELEVATION
- 8 — SURVEY CONTROL LAYOUT POINT
- LIMIT OF CLEARING
- A / 10 10 — SECTION OR PROFILE; SHEET NO. ON WHICH SECTION IS LOCATED; SHEET NO. ON WHICH SECTION IS FIRST CUT
- 5 / 6 7 — DETAIL; SHEET NO. ON WHICH DETAIL IS LOCATED; SHEET NO. ON WHICH DETAIL IS FIRST CALLED OUT
- SF — SILT FENCE
- LOD — LIMIT OF DISTURBANCE
- LIMIT OF SWMU

- WASTE ASH: MIXTURE OF WASTE ASH MATERIAL, TOPSOIL, FILL, CLAYEY SILT, AND SANDY SILT
- SAND
- SILTY SAND
- (SAND, SILTY SAND) NATURAL SAND
- SILTY CLAY
- WATER LEVEL

ABBREVIATIONS

AASHTO	AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
ADDL	ADDITIONAL
AOC	AREA OF CONTAMINATION
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS
C.B.	CATCH BASIN
CMP	CORRUGATED METAL PIPE
C.Y.	CUBIC YARD
DI	DRAINAGE INLET
DIA., ø	DIAMETER
EL., ELEV.	ELEVATION
EXIST.	EXISTING
F.M.	FORCEMAIN
FT.	FEET
HOR	HORIZONTAL
I.D.	INSIDE DIAMETER
IDEM	INDIANA DIVISION OF ENVIRONMENTAL MANAGEMENT
INV.	INVERT
L.F.	LINEAR FEET
LOD	LIMIT OF DISTURBANCE
MH	MANHOLE
MW	MONITORING WELL
MAX.	MAXIMUM
MIN.	MINIMUM
NTS	NOT TO SCALE
O.C.	ON CENTER
O.D.	OUTSIDE DIAMETER
OE	OVERHEAD ELECTRIC
PSI	POUNDS PER SQUARE INCH
PRB	PERMEABLE REACTIVE BARRIER
R.O.W.	RIGHT-OF-WAY
SCH.	SCHEDULE
SWMU	SOLID WASTE MANAGEMENT UNIT
SF	SILT FENCE
SQ.	SQUARE
TEMP.	TEMPORARY
TYP.	TYPICAL
UP	UTILITY POLE

DRAWING INDEX

DWG.	TITLE
1	INDEX, LEGEND, AND ABBREVIATIONS
2	EXISTING SITE PLAN
3	SITE DEVELOPMENT PLAN
4	PERMEABLE REACTIVE BARRIER PROFILE AND DETAIL
5	SITE GRADING PLAN
6	EROSION AND SEDIMENT CONTROL DETAILS (TO BE PROVIDED)

GENERAL NOTES:

1. CONTRACTOR SHALL VERIFY ALL EXISTING SITE CONDITIONS WITHIN THE WORK LIMITS.
2. EXISTING FEATURES ARE GENERALLY SHOWN "HALF TONE" IN ALL DRAWINGS EXCEPT AS SPECIFICALLY NOTED OTHERWISE.
3. THE CONTRACTOR SHALL PROTECT ALL EXISTING FACILITIES WHICH ARE DESIGNATED TO REMAIN.
4. THE HORIZONTAL AND VERTICAL SURVEY CONTROL DATUM TO BE USED DURING CONSTRUCTION SHALL BE THE SAME AS THAT PROVIDED ON THE EXISTING SITE CONDITIONS PLAN.
5. THE CONTRACTOR SHALL NOTIFY ALL UTILITY COMPANIES OR AGENCIES AND RECEIVE CLEARANCE TO WORK PRIOR TO EXCAVATING, GRADING OR SIMILAR WORK.

FOR BIDDING PURPOSES ONLY
NOT FOR CONSTRUCTION

NO.	REVISIONS	BY	DATE

INDIANA LIC. NO.

DESIGNED	INITIALS
MICHAEL AZZARELLA	M.P.A.
DRAWN	
KEN KOSTOWNIAK	K.W.K.
CHECKED	
MICHAEL ASQUITH	M.A.
APPROVED(DESIGN)	
APPROVED(CONSTRUCTION)	

URS Corporation

REV. NO. –

DUPONT

Corporate Remediation Group

An Alliance between DuPont and The URS Diamond Group

Barley Mill Plaza, Building 27
Wilmington, Delaware 19880-0027

INDEX, LEGEND, AND ABBREVIATIONS

DUPONT EAST CHICAGO SITE
PERMEABLE REACTIVE BARRIER
IRM PROJECT

SCALE	DATE	DRAWING NO.	SHEET
NONE	JUNE 2001	DC-8453	1

This drawing was computer generated. Any changes and/or revisions should be made to the CADD drawing file.

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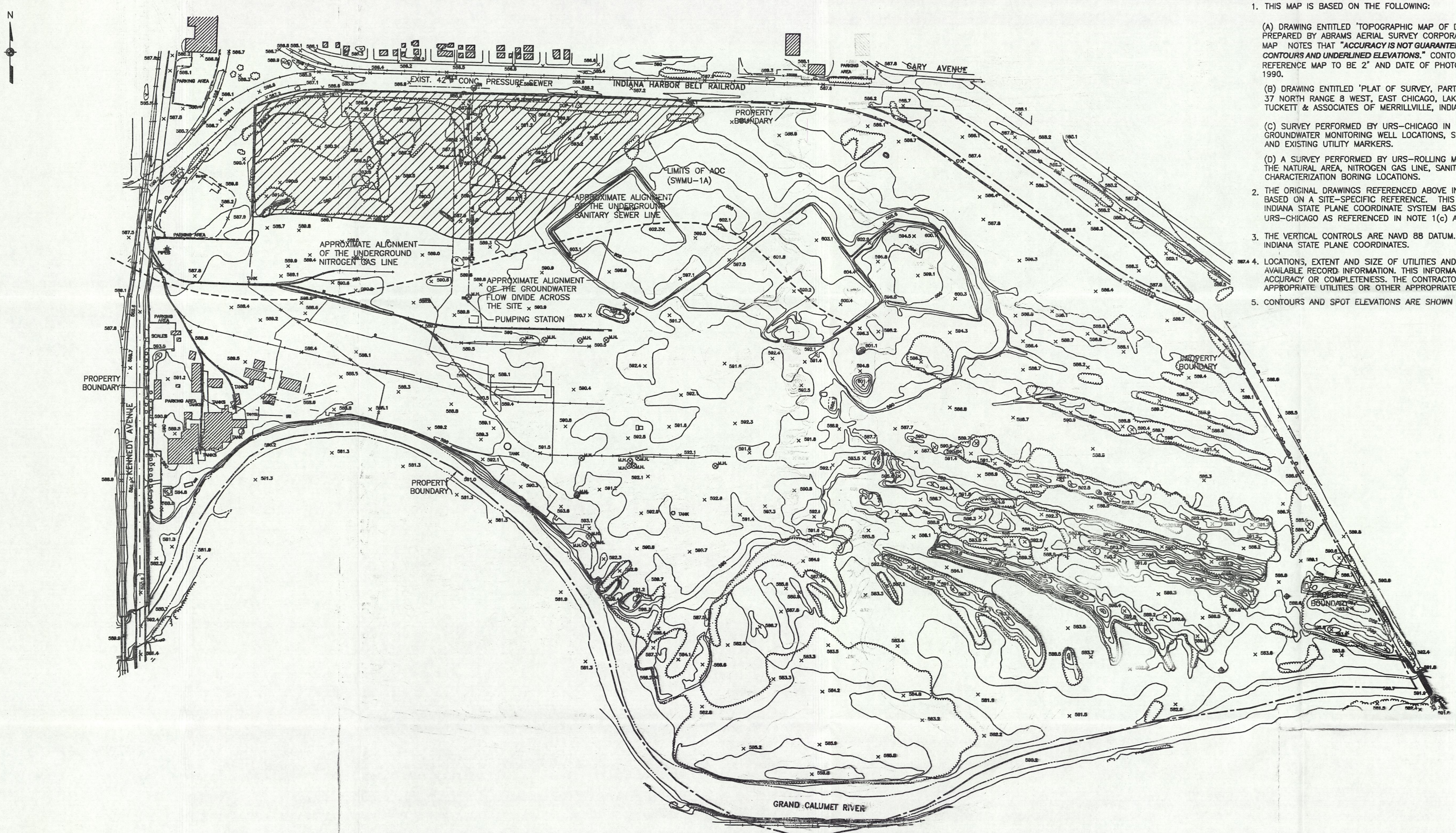

NOTE:

1. THIS MAP IS BASED ON THE FOLLOWING:

(A) DRAWING ENTITLED 'TOPOGRAPHIC MAP OF DUPONT PLANT EAST, CHICAGO, INDIANA' PREPARED BY ABRAMS AERIAL SURVEY CORPORATION OF LANSING, MI. THE REFERENCE MAP NOTES THAT ***"ACCURACY IS NOT GUARANTEED IN OBSCURED AREAS SHOWN BY DASHED CONTOURS AND UNDERLINED ELEVATIONS."*** CONTOUR INTERVAL WAS SHOWN IN THE REFERENCE MAP TO BE 2' AND DATE OF PHOTOGRAPHY WAS INDICATED AS MARCH 27, 1990.

(B) DRAWING ENTITLED 'PLAT OF SURVEY, PARTS OF SECTIONS 33 AND 34, TOWNSHIP 37 NORTH RANGE 8 WEST, EAST CHICAGO, LAKE COUNTY, INDIANA', PREPARED BY PLUMB TUCKETT & ASSOCIATES OF MERRILLVILLE, INDIANA AND DATED JANUARY 15, 2001.

(C) SURVEY PERFORMED BY URS-CHICAGO IN 1999 OF SELECTIVE SOIL BORING AND GROUNDWATER MONITORING WELL LOCATIONS, SELECTED PHYSICAL FEATURES AT THE SITE AND EXISTING UTILITY MARKERS.

(D) A SURVEY PERFORMED BY URS-ROLLING MEADOWS, IN 2001 OF THE LOCATIONS OF THE NATURAL AREA, NITROGEN GAS LINE, SANITARY SEWER LINE AND WASTE CHARACTERIZATION BORING LOCATIONS.

2. THE ORIGINAL DRAWINGS REFERENCED ABOVE IN NOTE 1(a) AND 1(b) WERE PREPARED BASED ON A SITE-SPECIFIC REFERENCE. THIS DRAWING HAS BEEN PLACED IN THE INDIANA STATE PLANE COORDINATE SYSTEM BASED ON THE SURVEY WORK PERFORMED BY URS-CHICAGO AS REFERENCED IN NOTE 1(c) ABOVE.

3. THE VERTICAL CONTROLS ARE NAVD 88 DATUM. HORIZONTAL CONTROL ARE BASED ON INDIANA STATE PLANE COORDINATES.

4. LOCATIONS, EXTENT AND SIZE OF UTILITIES AND SUBSTRUCTURES ARE BASED ON AVAILABLE RECORD INFORMATION. THIS INFORMATION IS NOT CERTIFIED AS TO ITS ACCURACY OR COMPLETENESS. THE CONTRACTOR SHALL CONSULT WITH THE APPROPRIATE UTILITIES OR OTHER APPROPRIATE *ENTITIES PRIOR TO COMMENCING WORK.*

5. CONTOURS AND SPOT ELEVATIONS ARE SHOWN HALFTONE FOR CLARITY.

Only copies from the original of this drawing that are marked with the original seal and signature of the Engineer, shall be considered as true valid copies.

FOR BIDDING PURPOSES ONLY
NOT FOR CONSTRUCTION

300' 0 300'
SCALE: 1"= 300'

URS Corporation

REV. NO. –

DESIGNED	INITIALS
MICHAEL AZZARELLA	M.P.A.
DRAWN	
KEN KOSTOWNIAK	K.W.K.
CHECKED	
MICHAEL ASQUITH	M.A.
APPROVED(DESIGN)	
APPROVED(CONSTRUCTION)	

NO.	REVISIONS	BY	DATE

INDIANA LIC. NO. ________

DUPONT

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Wilmington, Delaware 19880-0027

EXISTING SITE PLAN

DUPONT EAST CHICAGO SITE PERMEABLE REACTIVE BARRIER IRM PROJECT

SCALE	DATE	DRAWING NO.	SHEET
AS SHOWN	JUNE 2001	DC-8455	2

This drawing was computer generated. Any changes and/or revisions should be made to the CADD drawing file.

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SURVEY CONTROL POINTS			
POINT	NORTHING	EASTING	ELEVATION
DUP-1	2321939.67	2851832.27	588.63
DUP-10	2322004.08	2850439.15	588.42

BARRIER LOCATION		
POINT	NORTHING	EASTING
1	2321838.90	2849987.83
2	2321784.91	2851987.15

N

2850000 E

2851000 E

2852000 E

2322000 N

2321000 N

EXIST. 42"ø CONC. PRESSURE SEWER

MH

INDIANA HARBOR BELT RAILROAD

DUP-10

DUP-1

U/G PETROLEUM LINE

WB-1 WC-1 WC-2 WC-3 PWB-3 WC-4 WB-5 WC-5 WB-6 WC-6 WC-7 WC-8 WC-9 WC-10 WC-11 WC-12 WC-13 WC-14 WC-15 WC-16 WC-17 WC-18 WC-19 WC-20 WC-21 WB-22 WB-23

WB-2 WB-3 WB-4 WB-7 WB-8 WB-9 WB-10 PWB-11 WB-11 WB-12 WB-13 WB-14 WB-15 WB-16 WB-17 WB-18 WB-19 WB-20 WB-21 PWB-21

1+00 2+00 3+00 4+00 5+00 6+00 7+00 8+00 9+00 10+00 11+00 12+00 13+00 14+00 15+00 16+00 17+00 18+00 19+00 20+00

END BARRIER STA. 20+00

REMOVE AND REPLACE FENCE AS REQUIRED

LIMITS OF DISTURBANCE

ALL TREES AND BRUSH WITHIN THE LIMITS OF DISTURBANCE SHALL BE CLEARED

℄ OF PERMEABLE REACTIVE BARRIER

TANKS

APPROXIMATE ALIGNMENT OF THE UNDERGROUND SANITARY SEWER FORCEMAIN

8" TRANSITE SANITARY SEWER F.M.

LIMITS OF AOC (SWMU 1A)

APPROXIMATE ALIGNMENT OF THE UNDERGROUND NITROGEN GAS LINE

APPROXIMATE ALIGNMENT OF THE GROUNDWATER FLOW DIVIDE ACROSS THE SITE

TANK

METER

M.H.

PUMPING STATION

FOR BIDDING PURPOSES ONLY
NOT FOR CONSTRUCTION

100' 0 100'
SCALE: 1"= 100'

NO.	REVISIONS	BY	DATE

INDIANA LIC. NO. _____

DESIGNED	INITIALS
MICHAEL AZZARELLA,	M.P.A.
DRAWN	
KEN KOSTOWNIAK	K.W.K.
CHECKED	
MICHAEL ASQUITH	M.A.
APPROVED (DESIGN)	
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SITE DEVELOPMENT PLAN

DUPONT EAST CHICAGO SITE
PERMEABLE REACTIVE BARRIER
IRM PROJECT

SCALE	DATE	DRAWING NO.	SHEET
AS SHOWN	JUNE 2001	DC-8458	3

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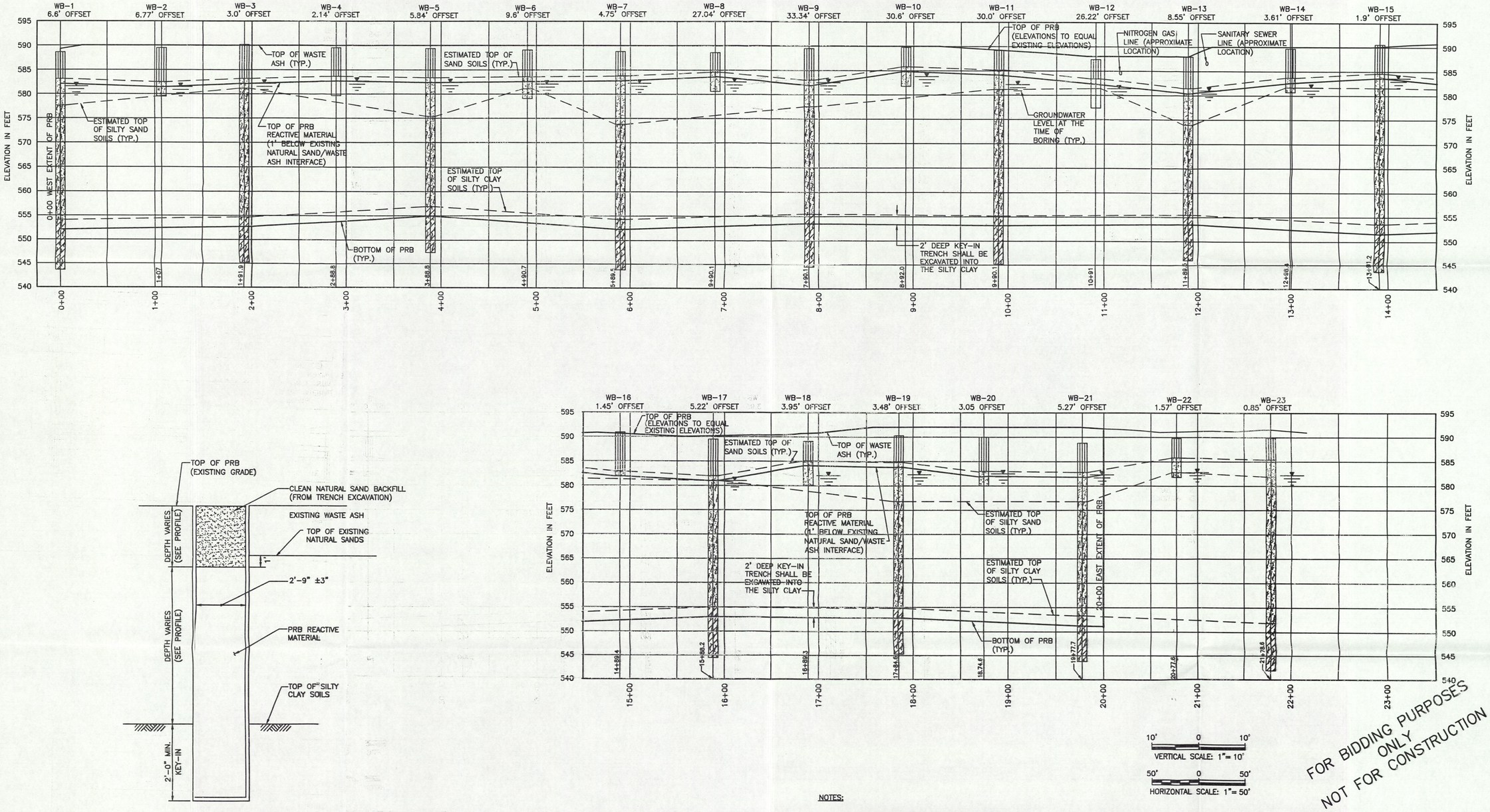

PERMEABLE REACTIVE BARRIER DETAIL

SCALE: 1/2"=1'-0"

10' 0 10'
VERTICAL SCALE: 1"= 10'

50' 0 50'
HORIZONTAL SCALE: 1"= 50'

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NOTES:

1. THE SUBSURFACE CONDITIONS SHOWN ARE BASED ON AN INTERPRETATION OF SUBSURFACE CONDITIONS COMPILED FROM INFORMATION PROVIDED ON BORING LOGS. ACTUAL CONDITIONS MAY VARY FROM THOSE SHOWN.

NO.	REVISIONS	BY	DATE
1	LOCATION OF THE SANITARY SEWER	RNS	6/29/01

INDIANA LIC. NO. _____

		INITIALS
DESIGNED	MICHAEL AZZARELLA,	M.P.A.
DRAWN	KEN KOSTOWNIAK	K.W.K.
CHECKED	MICHAEL ASQUITH	M.A.
APPROVED(DESIGN)		
APPROVED(CONSTRUCTION)		

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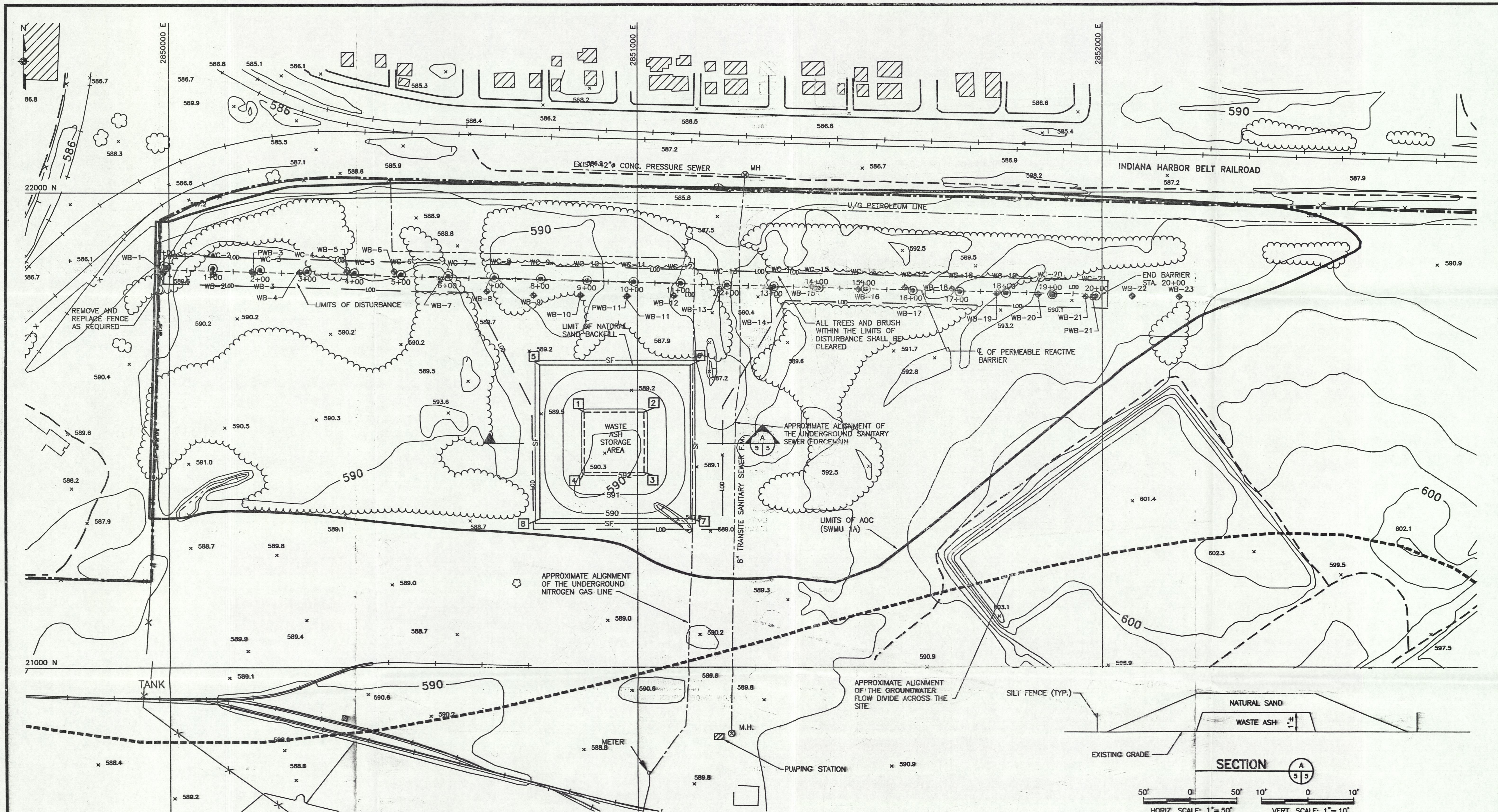
PERMEABLE REACTIVE BARRIER PROFILE AND DETAIL

DUPONT EAST CHICAGO SITE
PERMEABLE REACTIVE BARRIER
IRM PROJECT

SCALE	DATE	DRAWING NO.	SHEET
AS SHOWN	JUNE 2001	DC-8454	4



LIMITS OF WASTE ASH STORAGE AREA

POINT	NORTHING	EASTING
1	2321499.48	2850886.43
2	2321499.48	2851014.17
3	2321371.78	2851014.17
4	23211371.78	2850866.43

LIMITS OF NATURAL SAND BACKFILL

POINT	NORTHING	EASTING
5	2321636.59	2850790.18
6	2321636.59	2851112.67
7	2321371.42	2851112.67
8	2321313.42	2850790.18

NOTE: ESTIMATED WASTE ASH STORAGE VOLUME = 1,345 CUBIC YARDS

100' 0 100'
SCALE: 1"= 100'

NO.	REVISIONS	BY	DATE

INDIANA LIC. NO. ____________

DESIGNED	INITIALS
MICHAEL AZZARELLA,	M.P.A.
DRAWN KEN KOSTOWNIAK	K.W.K.
CHECKED MICHAEL ASQUITH	M.A.
APPROVED (DESIGN)	
APPROVED(CONSTRUCTION)	

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Barley Mill Plaza, Building 27
Wilmington, Delaware 19880-0027

SITE GRADING PLAN

DUPONT EAST CHICAGO SITE PERMEABLE REACTIVE BARRIER IRM PROJECT

SCALE	DATE	DRAWING NO.	SHEET
AS SHOWN	JUNE 2001	DC-8623A	5

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
. CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF

DE-9J

SEP 21 2001

Mr. Hilton Frey, Manager
Business Programs
DuPont Specialty Chemicals
6324 Fairview Road
Charlotte, North Carolina 28210

Re: Approval of Proposal for
Permeable Reactive Barrier Wall
DuPont East Chicago, Indiana
EPA ID No.: IND 005 174 354

Dear Mr. Frey:

This letter is to inform you that the United States Environmental Protection Agency (U.S. EPA) has reviewed the Permeable Reactive Barrier Wall Workplan. This document was submitted to U.S. EPA on July 2, 2001, and followed up our discussions of March 8, 2001. The Permeable Reactive Barrier Wall will be implemented as an Interim Remedial Measure (IRM) to address the potential migration of arsenic towards the Riley Park area.

Based on our review, the Workplan is hereby approved. It is our understanding that pilot testing of the trenching equipment will begin the week of September 24, 2001, with full scale implementation to follow. It is also our understanding that a post IRM monitoring plan will be submitted U.S. EPA to evaluate the effectiveness of the IRM.

If you have any questions regarding this approval, please phone me at (312) 886-6194.

Sincerely yours,

Allen T. Wojtas

Allen T. Wojtas
Project Coordinator

East Chicago
Arsenic Permeable Reactive Wall:
Lab and Field Testing Program

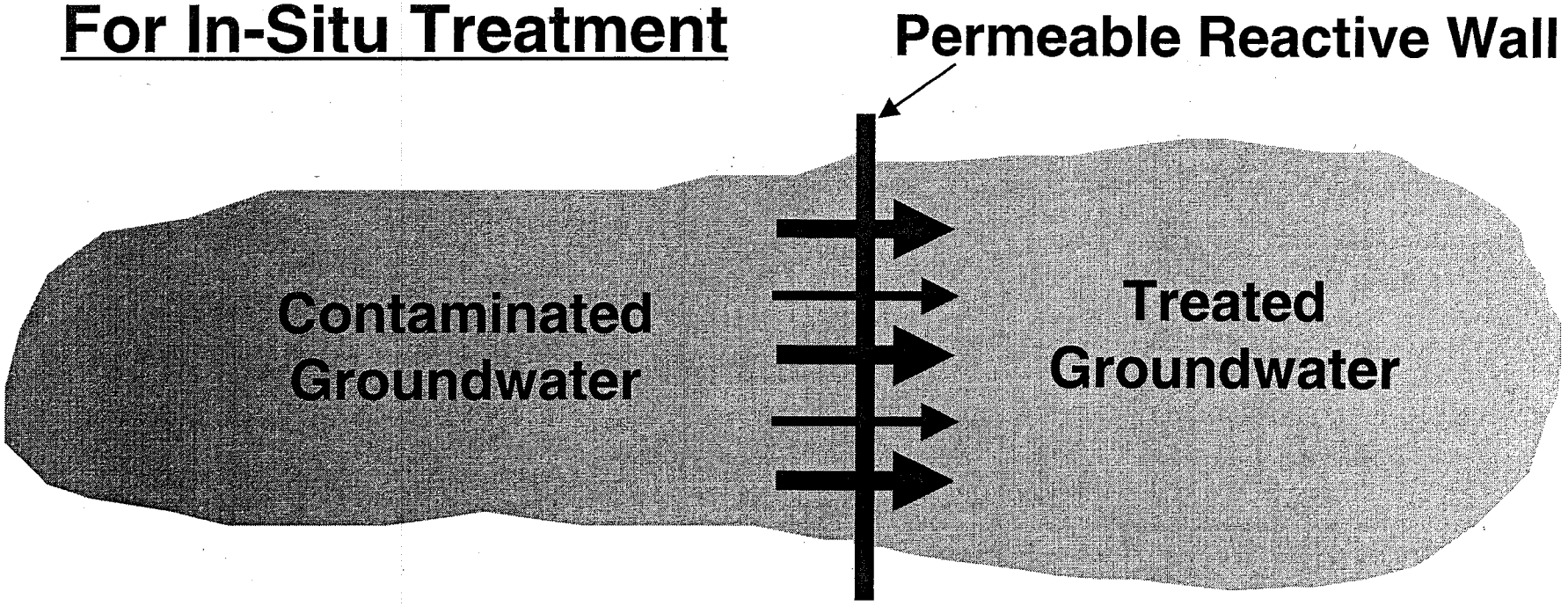
March 8, 2001

Overview

- REACTIVE ZONES - PERMEABLE REACTIVE WALLS
- REACTIVE ZONE MATERIALS
  - Granular zero valent iron -- active for dechlorination and metals removal
  - Cost $400/ton
- LABORATORY DATA ON ALTERNATE MATERIALS
  - Steel & iron slags, by-product/reprocessed materials
  - Lower activity, narrower applicability
  - Cost potentially $10-80/ton
- "IN SITU" FIELD COLUMN TESTS
  - Testing performance of promising materials under actual field conditions
  - Material selection for full scale project

Permeable Reactive Wall

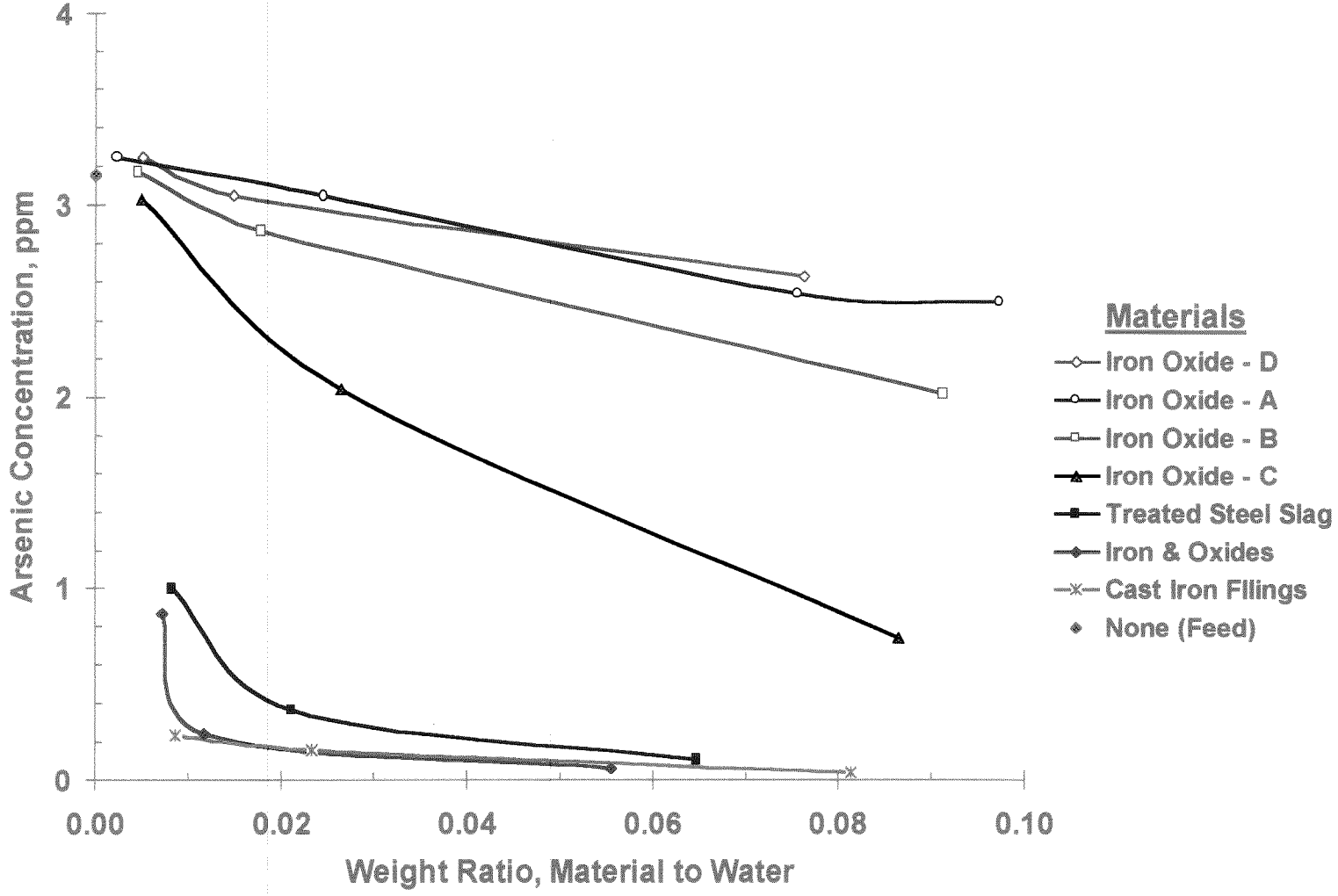
For In-Situ Treatment



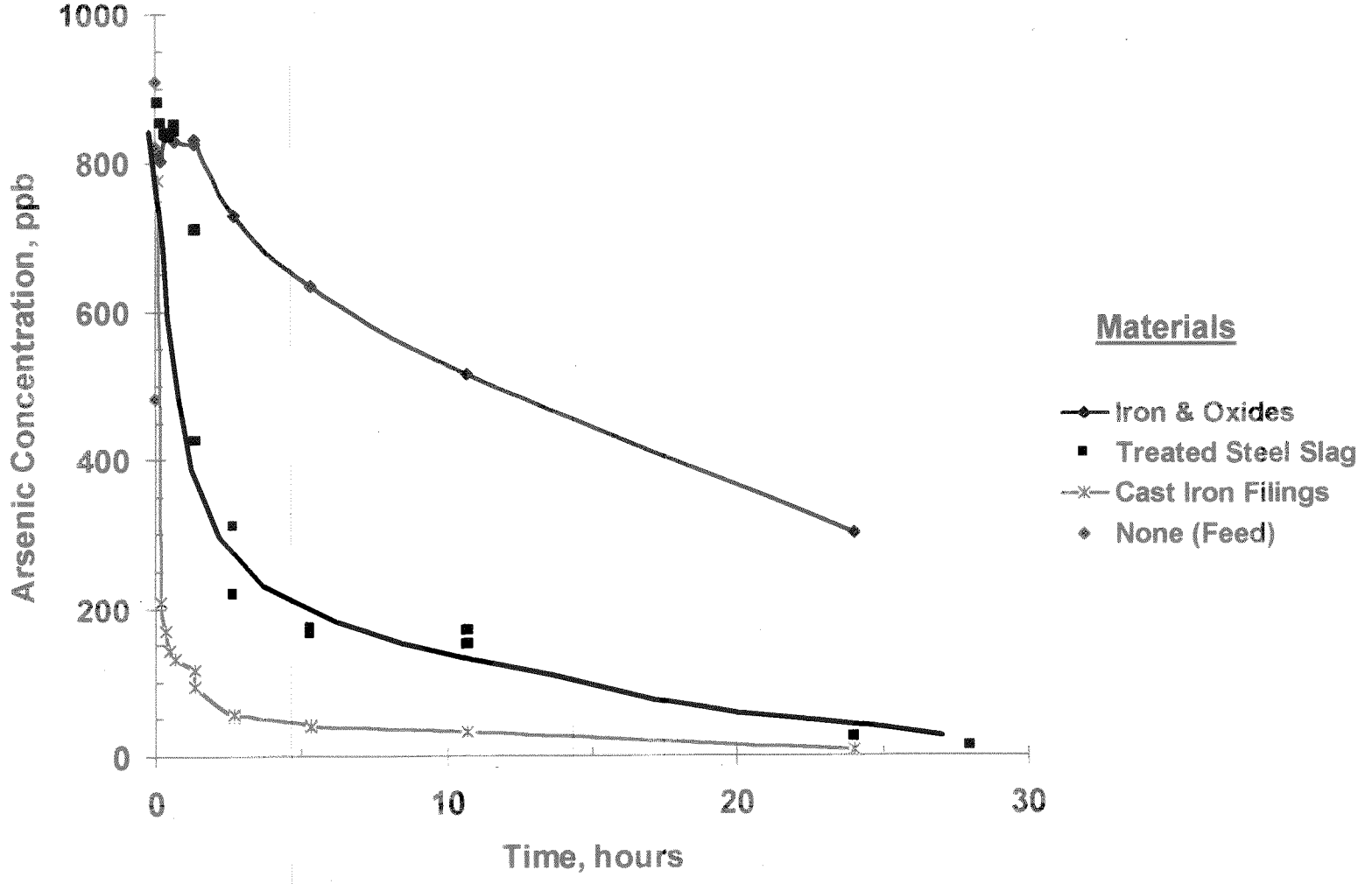
Groundwater Flow →

Contaminant Flow via Advection/Convection →

Arsenic Removal by Iron By-Product Materials
Batch Screening Test - 1



Arsenic Removal by Iron By-Product Materials
Kinetic Screening Test



Steel & Iron Slags

- STEEL-MAKING SLAG
  - Contains iron and iron oxides
  - Road-building grade available at $8/ton
  - Lime content raises pH of groundwater
  - Other grades and commercially altered forms available
- IRON-MAKING SLAG
  - Essentially iron free, general activity not expected
  - Lime content raises pH of groundwater

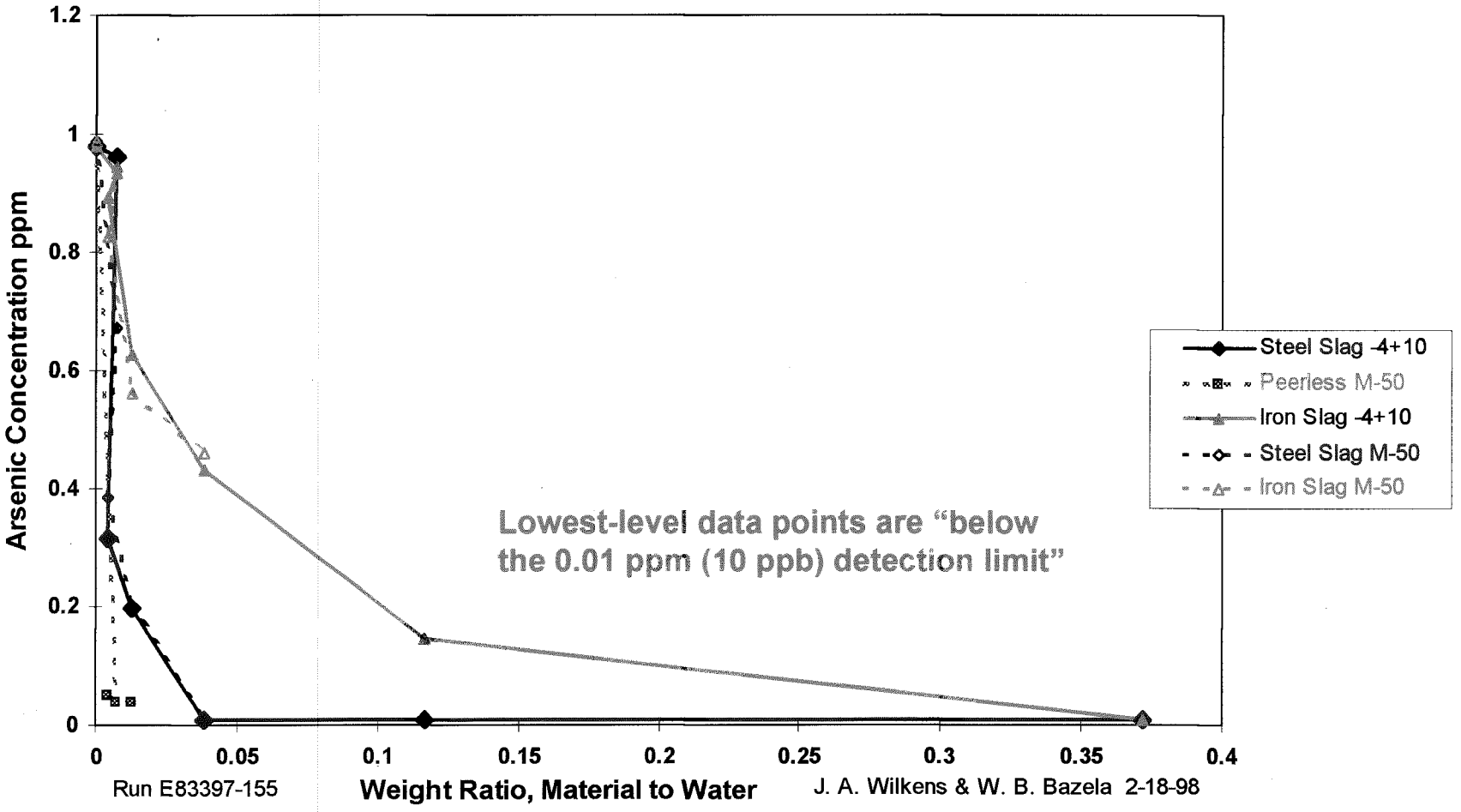
Steel and Iron Slags for Remediation Tests

COMPOSITION

Component	Steel Slag Basic Oxygen Furnace Wt. Percent	Iron Slag Blast Furnace Wt. Percent
Fe metal	3	
FeO	24	0.7
Fe2O3	3	
CaO	30	40.2
MgO	12	10.3
SiO2	10	36.1
Al2O3	2	10.1
TiO2		2.7
K2O		0.4
MnO	2	0.4
S		1.1
P2O5	0.2	
Total:	86.2	102.0

(Continued)

Arsenic Removal by Alternate Materials: Batch Test



Run E83397-155

J. A. Wilkens & W. B. Bazela 2-18-98

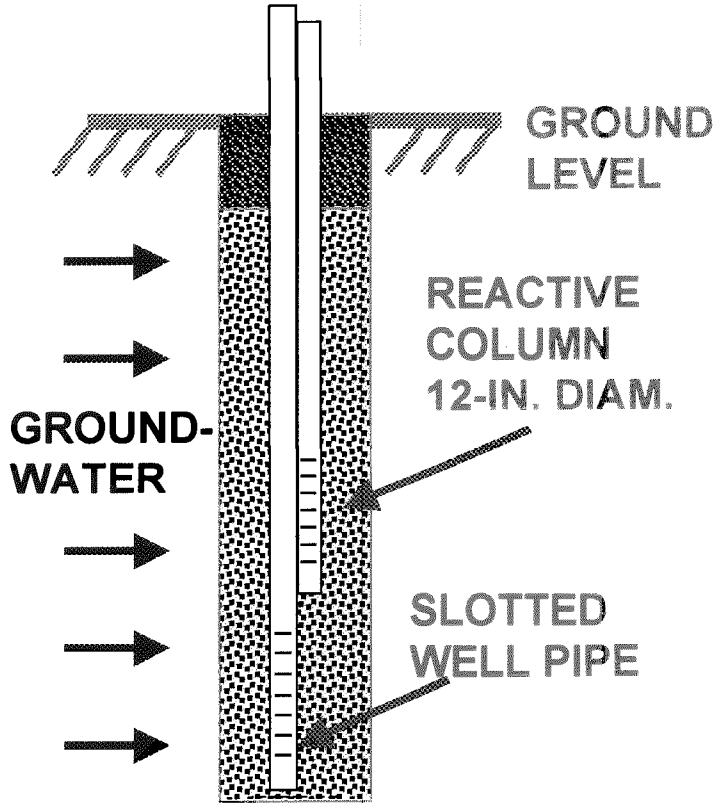
Iron & Steel Slag Performance

- SLAG PERFORMANCE
  - Both iron and steel slag show the capacity to remove arsenic to below 10 ppb
  - Steel slag shows <10 ppb removal at 4 material wt. percent
  - Iron slag shows <10 ppb removal at 38 material wt. percent
- IMPLICATIONS
  - BOF slag could serve as cost-effective PRW material, removing arsenic from groundwater to non-detect levels
- FURTHER INFORMATION NEEDED
  - Performance of materials under in situ geochemical conditions for extended periods

Field Test -- Arsenic Removal

- Purpose
  - Determine PRW efficacy, cost, design parameters
- In-ground test columns
  - 12-in diameter, 35 feet deep, keyed into clay
  - Reactive material filled
  - Two, one-inch screened sampling wells down center
- Technical Benefits
  - Actual groundwater chemistry and conditions
  - Close approximation to final wall
  - Maintenance-free test
  - Test continues with no cost but sampling and analysis

In-Situ "Column Test Well"



- IN-GROUND TEST COLUMN
  - 12-in diameter, 35 feet deep, keyed into clay
  - Two, One-inch sampling wells
    - Two-foot slotted sections
- SAMPLING
  - Low-flow sampling
  - Shallow, deep

In Situ Column Wells
Test Materials

- Cast iron (Zero-Valent Iron)
  - -8 +50 mesh (Peerless; ETI standard)
- Steel Process BOF Slag
  - Bethlehem Steel, via Levy Co.
- Millscale
  - LTV, via Levy Co.
- Silica Sand
  - Control standard, via U.S. Silica

Field Test -- Installation

- Two sets of columns
  - One set at each geo-chemical area
  - Five materials/concentrations plus control
    - Materials mixed into silica sand

- Installation: March 2000
  - Rotosonic drilling

Arsenic Removal Results After Seven Months (April - Oct. 2000)

Material	South Side				North Side			
	Shallow		Deep		Shallow		Deep	
Sand -- Control	*10*	=	*16,300*	▲	*42*	▲	*1000*	▲
Iron - 5%	*ND*	=	*3,400*	▲	*ND* **	=	*3100* **	▲
Millscale - 5%	~ND	=	18,000	▲	30	=	3000	▲
Millscale - 20%	30	▲	*7,800*	▼	*400* **	▼	*1100* **	=
BOF Slag - 30%	ND	=	*ND*	=	*ND*	=	*ND*	=
BOF Slag - 100%	ND	=	*ND*	=	*~ND*	=	*~ND*	=

Arsenic concentrations in ppb; MDL = 5 ppb; PQL = 10 ppb

** assume shallow-deep data reversal, adjusted here

Concentrations generally representative of total and dissolved, which are close

Increasing	▲	*November data dark red, italics*
Steady	=	July data black, standard font
Decreasing	▼	Red arrow indicates direction change from July

Material Results & Conclusions

- ZERO-VALENT IRON
  - Did not perform as well as expected from laboratory tests
- MILLSCALE
  - Did not perform as well as expected from laboratory tests
- BOF SLAG
  - Consistently best performer by a wide margin
  - Further development in progress for basic data package

Technical Program

- LABORATORY INVESTIGATION
  - BOF Slag performance and longevity projections
    - Effects of lower pH in PRB: slag pretreatment
    - Determine key parameters
  - High pH in PRB (lime presence)
    - Simulate buffering action of sands after water leaves PRB
  - Work with slag supplier to assure proper material availability

- MODELING
  - Coordinated with laboratory programs
  - Increase understanding of mechanisms